

METHOD OF MANUFACTURING UNVULCANIZED ADHESIVE WATERPROOF SHEET AND CONSTRUCTION METHOD USING THE SAME

This application relies for priority upon Korean Patent Application No. 1999-50626,
5 filed on November 15, 1999, the contents of which are herein incorporated by reference in
their entirety.

[Field of the Invention]

FIELD OF THE INVENTION

10 The present invention generally relates to a method for manufacturing of an
unvulcanized adhesive waterproof sheet and a construction method using the sheet.
Particularly, the present invention relates to a method of manufacturing an unvulcanized
adhesive waterproof sheet for [waterproof]waterproofing of a cut and cover tunnel, an
underground building structure[of a building], [and]or a concrete structure such as a building
15 wall [and]or an underground driveway. And, particularly, the present invention relates to a
construction method using the sheet.

[Background of the Invention]

BACKGROUND OF THE INVENTION

20 As civil and construction technologies have [recently been
developed]progressed, complex and difficult [constructions]construction methods can now
easily be accomplished. However, defects often occur [only] in [the] waterproof construction
situations. The [detects]defects cause water leakage and [submergence]flooding. Moreover,
the defects [bite and attack]can cause a completed structure to sustain damage and lead to
25 structural deterioration. Accordingly, a waterproof construction [becomes]is important in the
civil and construction technologies. [In the]At present[time], it is [desperately
required]desirable to produce excellent waterproof materials which can exert a continuous
and perfect waterproof function [with only one waterproof construction]without subsequent
need for maintenance or replacement.

30 Accordingly, a penetrating silicon [penetration] waterproof agent, a rubberized
asphalt sheet, a water soluble rubberized asphalt paint (aqueous paint film waterproof), a
vulcanized rubber (boiled rubber) sheet, and an organic solvent rubber paint (oil paint film
waterproof) have been used.

Since [a] cement strength [of the cement is] has improved to over 400kg/cm² due to development of the construction technology, [the] penetration waterproof agent [is] has proved to be [unsuitable] a dispreferred material.

[The] A rubberized asphalt sheet is cheap, and [exerts a good function in] performs
5 well a short time [because a physical property of the asphalt is] after installation when
waterproofed. Unfortunately, the elasticity of the rubberized asphalt sheet [is reduced
as] degrades with the passage of time[elapses. Since]. In hot weather (e.g., summer), the sheet
is dissolved and vaporized [at a high temperature (e.g., summer), it becomes hard. And, a
volume of]. As this happens, the sheet [is reduced. This results] hardens and shrinks, resulting
10 in water leakage and [submergence. When] flooding.

Further, when the rubberized asphalt sheet [attaches] is attached to external walls of a
construction structure, humidity or moisture makes it impossible to [carry out an] attach the
rubberized asphalt sheet to the concrete (or similar material) construction. Although a surface
of the external wall [is] may be dried well, the sheet only partially attaches thereto. Thus, a
15 conventional rubberized asphalt sheet has [rarely been used in recent] fallen into disfavor.

In the water soluble rubberized asphalt paint, asphalt is mixed and agitated
with emulsifier, and latex is added thereto[then]. Accordingly, [a construction of a
connecting portion becomes simple] application of asphalt paint (i.e. the waterproof material)
is simplified. However, since a main [material] ingredient of the paint is asphalt, [it] the paint
20 has the same drawbacks as [the foregoing] a rubberized asphalt sheet. Moreover, [the] liquid
asphalt paint is [vulnerable to a concave-convex structure (i.e., it is impossible)] difficult to
apply to form a waterproof film having a constant thickness[] if the construction surface is
not planar.

[The] A vulcanized rubber sheet is [boiled in a manufacturing process,
25 and] manufactured by boiling, and such a sheet has greater elasticity, tension, and tensile force
[that are original properties of] than untreated rubber. Accordingly, the vulcanized rubber
sheet is good for [shake] resistance to vibration, shock[resistance], and [chemical
resistance] chemicals. In addition, physical [property] properties and waterproof [function
thereof is] performance are excellent. The vulcanized rubber sheet, however, [has difficulties
30 in entirely attaching] is difficult to completely attach to external walls of a structure[and
performing construction of a connecting portion]. This results in water leakage and
deterioration of the waterproof function.

In order to remedy drawbacks of the above-mentioned waterproof materials,
[the] organic [solvent] rubber paint [is] was developed which uses rubber as a [main] base

material. The rubber is [resolved]dissolved in a volatile solvent, such as toluene and thinner, using a liquid agitator, [manufacturing]to manufacture the organic solvent rubber paint. Compared with the vulcanized rubber sheet, the [paint makes it simple to perform the construction of the connecting portion. When a solvent is dried]rubber paint is simpler to use.

5 When the solvent is evaporated, the rubber paint is [changed]transformed to a rubber sheet. Therefore, [the]organic[solvent] rubber paint is a good waterproof agent. However, elasticity, peel strength, and tensile force of [the]rubber paint are lower than those of a vulcanized rubber sheet because the manufactured rubber sheet is [situated]in an unvulcanized rubber gray state. If a paint film waterproof agent using an oil rubber as a main

10 material is [coated]applied once, a rubber film is formed after [drying a]evaporation of the solvent. At this time, the rubber film [is shrunken]shrinks and [a]the thickness thereof is reduced to 0.2mm-0.4mm. In order to form a waterproof film having a constant thickness (1mm-2mm), [the waterproof agent should]rubber paint must repeatedly be coated. Since the [waterproof agent is coated once and]each coat of rubber paint must be left for 5-6 hours so

15 as to dry the solvent, soil or dust is fixed to a coating surface. Therefore, the waterproof film is divided into a plurality of films. Further, air [bubble]bubbles or air [pocket is]pockets are considerably likelier to be created under the rubber film formed by rubber paint.

Although concrete used in civil and construction structures is dried well, it generally [contains]has a moisture content of 10%-20%. In most case, concrete used in an

20 underground structure [contains]has a moisture content of 80%-90%. As mentioned above,[a] moisture content of the conventional waterproof agents is high. Therefore, the agents cannot attach to the concrete. Although a waterproof agent [forcibly attaches]can be attached to concrete using a lamp or a burner, [a waterproof]the resultant construction is still [unstable]unstably attached and waterproof defects [are created in the construction]can be

25 present.

In order to prevent damage of the waterproof film, the conventional waterproof agents must use a waterproof film protectant such as an EVA (ethylene vinyl acetate) bubbling sheet or a PE (polyethylene) fibrous sheet. However, the protectant is forced out or damaged and the waterproof film is attacked in a refilling process.

30 Unfortunately, the protectant causes the defects. On the other hand, in order to protect the waterproof film, bricks are laid to form a wall, and then a refilling process is carried out. Such a manner [delays a]increases both the term of [works]the work and [requires excessive]the cost.

[Summary of the Invention]SUMMARY OF THE INVENTION

It is therefore an object of the invention to provide a method of manufacturing an unvulcanized adhesive waterproof sheet and a construction method using the sheet which can simply perform a waterproof construction of a civil structure [or a construction structure,]
5 [and maintain [a]waterproof [function]performance for a long time.

It is another object of the invention to provide a method of manufacturing an unvulcanized adhesive waterproof sheet and a construction method using the sheet which can easily and stably [perform a waterproof]be attached to a construction[to a] surface containing
10 humidity or moisture.

According to an aspect of the invention, a method of manufacturing an unvulcanized adhesive waterproof sheet comprises the steps of agitating a rubber main material composed of at least one of a natural rubber and a synthetic rubber with a vulcanizing compound agent, an age resister, an adhesion-providing agent, a softener, and a
15 filler, and then adding and agitating a vulcanizing agent thereto in an open roller, thereby producing a raw rubber material; rolling and forcing out the raw rubber material with constant width and thickness, thereby manufacturing a waterproof sheet; and [making]attaching a releasing paper [attach]to both surfaces of the waterproof sheet, being cut with a constant length.

The age resister includes at least one compound selected from a group consisting of phenylisopropyl-p-phenylenediamin, polymerized trimethyl dihydroquinoline, and styremeated phenol. The adhesion-providing agent includes at least one of tragacanth rubber and polyvinyl poval (PVA) that is affined with water.

According to another aspect of the invention, [there is]a construction method
25 [using]uses the unvulcanized adhesive waterproof sheet. One surface of the waterproof sheet attaches to a surface of a structure[surface]. The other sheet surface[thereof] attaches to wet mortar[with], the sheet having a constant thickness. At this time, the waterproof sheet is turned into a vulcanized rubber so as to achieve [waterproof]waterproofness of the structure after attachment thereto of the [construction]sheet.

Before the waterproof sheet attaches to the surface, premier [which is][(produced by [resolving]dissolving the raw rubber material in organic solvent) is coated on the [structure]construction surface. When the waterproof sheet attaches to the surface, the waterproof sheet and the [structure]construction surface are coupled and
30 [overlapped]opposed with each other. Then, the overlapped portion adheres [using]to the

construction surface via the premier. Before the waterproof sheet attaches to the surface, [a portion of] water leakage, which [is] may be caused by cracks of the [structure] construction surface [is], are closed using an adhesion agent produced by [resolving] dissolving the raw rubber material in a [constant] selected amount of organic solvent. After the cracks are closed
5 using the adhesion agent, the premier is coated on the surface.

[Description of the Preferred Embodiment]

DESCRIPTION OF THE PREFERRED EMBODIMENT

[In functions, a] A waterproof agent made of asphalt is superior in performance to that
10 made of rubber. Accordingly, [the inventor of this invention thinks that] a perfect waterproof sheet must have [conditions] characteristics as follows. First, [a] an ideal rubber film has a constant thickness. Second, [connection parts] the elements of the composite are monolithically and easily coupled to each other, and perfectly attach to each other. Third, a waterproof sheet to be used in construction [is performed using] should be a vulcanized
15 rubber sheet having good elasticity, tension, and tensile force that are intrinsic properties of a rubber. [In view of such facts, the inventor previously got] Reference is directed to patents using an unvulcanized adhesive waterproof sheet using rubber as a main material (Korean Patent Application No. 95-5008 entitled "MANUFACTURING METHOD OF UNVULCANIZED ADHESIVE WATERPROOF SHEET AND CONSTRUCTION
20 METHOD THEREOF" and Korean Patent Application No. 96-37884 entitled "METHOD OF MANUFACTURING UNVULCANIZED ADHESIVE WATERPROOF SHEET ").

In these patents, an adhesive gray-state unvulcanized waterproof sheet
[adding] with a vulcanized agent is manufactured [with] to have a constant width and thickness. Accordingly, in a construction process using the sheet, [a construction] the
25 thickness is constant and [connecting parts] attaching surfaces are monolithically [attaches] attached to each other. This makes it possible to [construct even a wide area using] attach a piece of rubber sheet to even a wide area. The sheet is [second] secondarily-activated at ordinary temperature, being turned into a vulcanized rubber sheet. Tension and tensile force of the sheet can fill concrete cracks due to [suture] sealing thereof. As a result,
30 the sheet provides a perfect water-stopping effect.

However, the adhesive gray-state unvulcanized waterproof sheet adding a vulcanized agent [must suffer] suffers from an aging phenomenon. For example, when the sheet is exposed to sunshine, rain, and wind on a rooftop of a building for three or four months, cracks are created on a surface of the sheet. Therefore, the present invention provides

a new and improved manufacturing method of an unvulcanized adhesive waterproof sheet and a waterproof construction thereof, with repetitive test and study.

The use of the present adhesive waterproof sheet in construction [of this invention] is performed through the following steps. Primer [that is](produced by
5 [resolving]dissolving a raw material of rubber in a constant amount of organic solvent) is coated on a construction surface. The unvulcanized rubber sheet [attaches]is attached to the surface. Wet cement mortar, which is kneaded with water, attaches [for protecting an attaching]to protect the attached waterproof film. The mortar is hardened and cured. Finally, a refilling process is performed. After the waterproof construction is finished, the sheet is
10 activated to be a [molding]molded vulcanized rubber with time. More specifically, primer is coated on, e.g., a cut and cover tunnel, an underground structure of a building, and a building wall. With an adhesive unvulcanized rubber sheet [of]in an adhesive rubber gray state, an [attaching]attachment to the construction surface is monolithically performed without an expansion opening. Wet mortar kneaded with water attaches onto a surface of the [attaching
15]waterproof sheet. [Moisture of the]The wet mortar is dried and cured. Since the mortar and adhesive unvulcanized rubber [have adhesion then]are adhesive, they strongly attach. The unvulcanized rubber sheet is [second]secondarily-activated at ordinary temperature, being turned into a [molding]molded vulcanized rubber sheet. [And then, the]The molding vulcanized rubber sheet then is turned into a rubber sheet having elasticity, tension, and
20 tensile force that are intrinsic properties of the rubber, [exerting]creating a perfect waterproof construction effect. Using the molded and vulcanized rubber sheet as a medium, both walls attach to each other by concrete. Therefore, it is possible to [perform]achieve a waterproof construction process without defects in waterproofness.

An unvulcanized adhesive waterproof sheet of this invention is produced by
25 adding a rubber material composed of at least one of natural rubber and synthetic rubber to a vulcanizing agent, an age resister, an adhesion-providing agent, a softener, a filler, and a vulcanizing agent. Such agents are added to natural rubber or synthetic rubber or combination thereof or a combined rubber produced by adding rubber powder or recycled rubber to the natural rubber or the synthetic rubber. The agents and one of the rubbers are then mixed and
30 agitated in a closed mixer (e.g., kneader or [bumberey]Bandury), being evenly distributed. [And then, the]The agitation is performed in an open roller, with [adding]addition of the vulcanizing agent. The agitated raw material of the adhesive rubber is rolled in a calender, having a constant width and a thickness of 1mm-5mm. The rolled material is fetched to the

sheet, and then is cut with a constant thickness. Finally, the rolled and fetched rubber sheet is rolled up, with silicon-coated releasing paper attaching to both surfaces thereof.

The unvulcanized adhesive rubber sheet [is used for unexposure]can be used in construction applications where the sheet will be exposed to the weather. Durability of the sheet is [over the warranty (]five years[)]. In order to maintain a waterproof function for a long time, it is required to add a special age resister to the sheet. Therefore, the present invention uses age resisters, such as "3C" (Phenylisopropyl-p-phenylenediamin), "RD" (Polymerized trimethyl dihydroquinoline), and "SP" (Styrenated phenol). The "3C" compound is good for heat resistance, flexure-crack resistance, oxidation resistance, and ozone resistance. The "RD" compound is good for heat resistance and oxidation resistance. [And, the]The "SP" compound is good for flexure resistance, oxidation resistance, and ozone resistance. Adding such age resisters to the sheet~~[, the]~~ results in a sheet which maintains [an]its initial state for a long time. When the sheet [attaching]attached to[a wall of] a rooftop is left for two years (two summers and winters), cracks or rips are not created on a surface of the sheet. In case of [an unexposure]a sun exposure construction application, the sheet exerts an excellent waterproof function for a long time.

Generally, a waterproof construction process is [performed to]desirable for an external wall of a structure. Accordingly, the construction is performed [to]in an external wall of concrete using a waterproof material. In order to protect the waterproof material, an EVA blowing sheet or PE fibrous sheet is applied to an outside of the waterproof material. However, the EVA blowing sheet or PE fibrous sheet is difficult [in attaching]to attach to a corner or a flexure (curved construction surface), and incompletely [attach]attaches to the waterproof material. In a refilling process, a protectant is forced out or damaged and a waterproof film is attacked. Unfortunately, the protectant also causes defects. Instead of EVA blowing sheet and PE fiber, cement mortar is used as a waterproof protectant so as to solve such defects and protect a waterproof film. Therefore, the rubber sheet can be simply attached to a corner or a complex flexure[can simply be constructed]. Using a waterproof sheet as a sandwiched medium, an inside construction surface adheres to an outside [by concrete,]construction surface , the sheet being closed therebetween to achieve a perfect waterproof construction.

In order to use mortar as a waterproof film protectant, the unvulcanized adhesive waterproof sheet adds Tragacanth Gum and PVA (polyvinyl Poval) resin to the adhesion-providing agent. The Tragacanth Gum and PVA resin is affined with water and is compatible with other material, being mixed well. The sheet containing an adhesion-

providing agent and the raw rubber material are [resolved]dissolved in a constant amount of organic solvent, forming premier which enables the sheet to perfectly attach to a [structure]construction surface containing [humidity or]moisture. Even though an underground structure contains moisture on the order of 80%-90%, the sheet can eminently
5 attach thereto. According to [an]experimental [result of the inventor]results, when the premier is coated on a brick or a concrete piece with gathered water and the unvulcanized adhesive rubber sheet [adheres]adhered thereto, the adhesion [becomes]is strong. Since a surface of a structure in a work site generally has poor adherence conditions, the primer is used [for enabling]to enable an unvulcanized adhesive waterproof sheet to attach to a
10 [structure]construction surface. And, the primer is used at an overlap portion of waterproof sheets.

In order to overcome conventional problems (exfoliation, cement exclusion, crack, etc.), the premier is coated on an external surface of concrete and the unvulcanized adhesive rubber sheet adheres thereon. Then, wet mortar kneaded with water attaches to a
15 surface of the sheet. If the water is dried and adhesion is created [in]by curing the cement mortar, [a]the waterproof film and the cement mortar strongly attach to each other. The sheet attaching [in]to the mortar can absorb external impact and suppress creation of cracks.

[On the other hand, the]In another embodiment, a construction method using the unvulcanized adhesive waterproof sheet utilizes putty that is produced by
20 [resolving]dissolving a raw rubber material in organic solvent such as toluene. The putty [closes a portion of]seals and prevents water leakage caused by cracks [of]in a [structure]construction surface. Using the putty, the cracks are closed. If the premier is then coated on the [structure]construction surface repeatedly and the sheet [attaches]attached thereon, [the more perfect]a better construction will be achieved.

25 In view of the cost, a waterproof construction method using an unvulcanized adhesive waterproof sheet is cheaper than a conventional method using an EVA blowing sheet[and], a PE fibrous sheet or a bricklaying method. And, such a waterproof construction method can solve conventional difficulties (e.g., a waterproof construction cannot be performed to a wet mortar kneaded in water as well as to a structure surface having humidity
30 or moisture, and the construction [is forcibly performed to create]in these situations tends to result in construction defects).

[<Preferred Embodiment>]

PREFERRED EMBODIMENT

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An unvulcanized adhesive waterproof sheet of this invention is composed of composites having a mixture ratio, as follows[.]:

Rubber Main Material	One of Natural rubber and Synthetic rubber (SBR rubber, 1R rubber, EPT rubber, 2R rubber, CR rubber, NBR rubber, Urethane rubber, and CPE rubber) or Combination thereof	100%
Vulcanizing Compound Agent	Stealic Acid	1%
	Magnesium Oxide	5%
	Zinc Oxide	5%
	Sulfur	2%
Age Resister	Age Resister 3C (Phenylisopropyl-p-[phenylenediamin]phenylenediamine)	2%
	Age Resister RD (Polymerized trimethyl dihydroquinoline)	1.5%
	Age Resister SP ([Styremeated]Styrenated phenol)	2%
Adhesion-providing Agent	Polybutene	6%
	Phenol-Formaldehyde-Resin	8%
	Petroleum Resin	10%
	PVA (Polyvinyl poval)	12%
	Tragacanth Gum	5%
Softener	Process Oil	14%
Filler	Calcium Carbonate	40%
	Clay	15%
Vulcanizing Agent	DM	1.6%
	D	1%
	T/T	1%
	NA22	1%

5 Intrinsic physical properties and characteristics of the rubber compound materials are different from each other. Therefore, based on usage of a waterproof sheet or

[requisition of a]user preference, only one of [the]natural [and]rubbers, synthetic rubbers, or a combination thereof may be used. Alternatively, two and more kinds of synthetic rubbers may be used. For example, a CR rubber main material has the best properties such as adhesion, durability, and chemical resistance.

5 The age resisters (3C, RD, and SP) are added to an unvulcanized adhesive waterproof sheet, improving durability. In order to maintain strong adhesion between composites of the sheet and provide adhesiveness, the adhesion-providing agents (polybutene, phenol-formaldehyde-resin, and petroleum resin) are added thereto. And, in order to provide adhesion and adhesiveness to wet mortar kneaded with water and a structure
10 having humidity and moisture, the tragacanth gum and the PVC resin which are compatible with other composites are added thereto. Since there are synergy and compatibility between a resin of an adhesion-providing agent and a water-compatible resin, adhesion and adhesiveness can be improved. And, a waterproof construction can smoothly be performed at dry and wet [portions]conditions.

15 A method of manufacturing an unvulcanized adhesive waterproof sheet is composed of the following steps. One of natural and synthetic rubbers (SBR rubber, 1R rubber, EPT rubber, 2R rubber, CR rubber, NBR rubber, Urethane rubber, and CPE rubber) or combination (100%) thereof is fully agitated in a closed mixture agitator "Kneader Mixer" or "Bandury Mixer". The vulcanizing compound agents, stearic acid (1%), magnesium oxide
20 (5%), zinc oxide (5%), and sulfur (2%) are evenly mixed therewith. The age resisters, 3C (2%), RD (1.5%), and SP (2%) are then agitated, being mixed and distributed evenly. Then, the adhesion-providing agents, polybutene (6%), phenol-formaldehyde-resin (8%), petroleum resin (10%), tragacanth gum (5%), and PVA (12%) are fully mixed and agitated therein. And then, the softener, process oil (14%) as well as the filler, calcium carbonate (40%) and clay
25 (15%) are fully mixed and agitated therewith. With adhesive unvulcanized raw rubber material agitated in a roller, vulcanizing agents, DM (1.5%), D (1%), T/T (1%), and NA22 (1%) are added, being distributed and mixed evenly. In [calender]a calendar machine, the sheet is rolled and forced out with a constant width and a thickness of 1mm-5mm. Finally, the sheet [adheres]is adhered to releasing paper of a high-density film (HD), polypropylene (PP),
30 and polyethylene (PE),[being] rolled up and cut with a constant length. The releasing paper of the rolled waterproof sheet must be uncovered in a waterproof construction. To be used as a material of the releasing paper, silicon is coated on both surfaces of a synthetic resin film such as HD, PP, and PE.

Since the unvulcanized adhesive waterproof sheet has [~~adhesion~~]adhesiveness therein, its adhesion to concrete is excellent. However, a [~~surface of a~~] construction surface of a structure in a work site is generally contaminated by cement powder, soil, dust, and [~~filth~~]dirt. Accordingly, the waterproof construction method utilizes premier (viscosity, 500-
5 600) [~~that are~~] produced by [resolving]~~dissolving~~ the raw rubber material (weight, 50) in toluene (weight, 150). That is, the premier is rendered on a concrete surface and the unvulcanized waterproof sheet attaches thereto, achieving a stronger [~~adhere~~]
construction]attachment. Similarly, a coupling portion more strongly adheres by means of the premier.

10 In comparison with a conventional method, the present invention makes it possible to simply coat the premier on a structure using a brush. The premier can [~~strongly~~]effectively be coated on even metal or rusted iron, so that the unvulcanized waterproof sheet simply and strongly attaches thereto.

In case of water leakage caused by cracks of a [~~structure~~]construction surface,
15 an adhesion agent (viscosity, 1500-1700)[~~that is~~] produced by resolving the raw rubber material (weight, 500) in toluene (weight, 70) is utilized. After the cracks are closed using the adhesion agent, the water leakage is stopped and the premier is coated thereon. After solvent is dried and a premier film is formed, the premier recoated thereon. A rubber sheet strongly attaches to the premier then, so that adhesion is achieved.

20 In the waterproof construction method, the unvulcanized adhesive waterproof sheet attaches to a [~~structure~~]construction surface. Mortar of 10mm-20mm then attaches to a surface of the waterproof sheet. The more [~~a~~] cement component ~~is~~ contained in mortar [~~is~~], the better adhesion is. Accordingly, [~~a~~]this quality of the mortar is [~~at least~~] higher than that of standard mortar (cement 1 : sand 2.5). Moisture of the attaching cement mortar is
25 [~~vaporized~~]evaporated to create adhesion. After five or seven days, the mortar is cured to have strong adhesion. The attaching mortar having the strong adhesion can resist external impact (i.e., overcome exfoliation, evasion, breakage, and cracks). Using the unvulcanized adhesive waterproof sheet as a medium, internal and external walls completely attach to each other. Thus, defects cannot occur.

30 In a waterproof construction to an external wall of a building, the premier is coated on the external wall to form a rubber film. Mortar kneaded with water attaches to a surface of the rubber film, being cured. Sidewalls are refilled with a good quality of earth and sand. Then, water is sprayed to harden the earth and sand. An underground parking lot or a rooftop is [~~subject~~]amenable to a mortar (thickness, 2cm-3cm) construction, and is refilled

[with]in the same manner. [So the]The waterproof construction is [finished]then conducted as previously described. At ordinary [temperature]temperatures, the unvulcanized adhesive waterproof sheet is [second]secondarily-activated, being turned into a vulcanized rubber [with]over time (1-2 months in summer, 2-3 months in winter). Therefore, the waterproof
5 sheet has high tension and tensile force, and maintains [a]its waterproof function. Further, heat resistance, cold resistance, and chemical resistance of the waterproof sheet [is so]are sufficiently good that the waterproof sheet can [exert]maintain its good physical properties in [a]severe [condition]conditions. As a result, the waterproof sheet can maintain a waterproof function [until a civil and construction]over the life of the building[is deconstructed].

10 In the drawings and specification, there have been disclosed typical preferred embodiments of the invention and, although specific terms are employed, they are used in a generic and descriptive sense only and not for purpose of limitation, the scope of the invention being set forth in the following claims.[